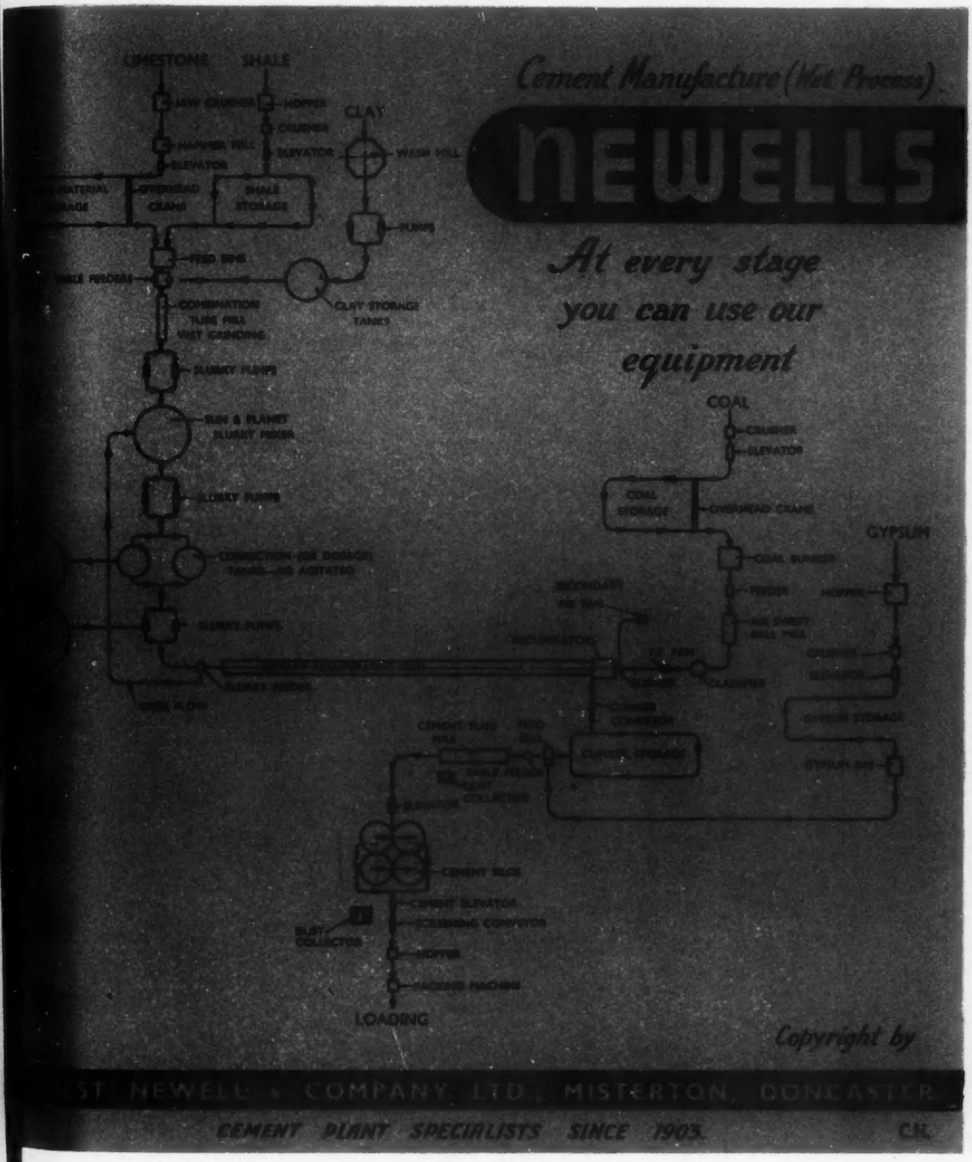
CEMENT AND LIME MANUFACTURE

VOL. XXVII. No. 6 | NOVEMBER, 1954 | Price 1s. Annual subscription 6s. ($1.30 in Canada and U.S.A.)

PUBLISHED BY CONCRETE PUBLICATIONS LTD., 14 DARTMOUTH STREET, LONDON, S.W.1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But, if quality control is important, a wide-ranging, fundamental research programme is vital to the development of new and better packaging products. At Bowaters Central Research Laboratories in Gravesend a team of scientists is constantly working to improve manufacturing methods and processes; to increase and develop the efficiency of Bowater products.

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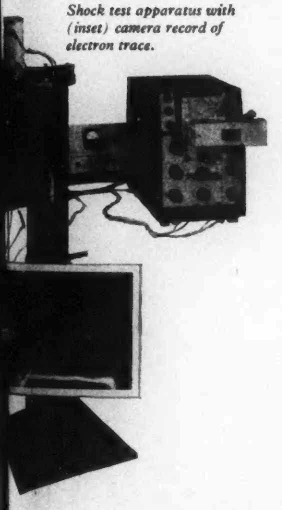
Shock test apparatus with (inset) camera record of electron trace.



alline products. These sacks travel er the country—and to go overseas d are subject to inevitable shocks strains in handling and transport. y have to be strong enough to stand rough treatment. This test repro- the worst effects of the roughest gh treatment and provides valu- data for the scientists in their search nger paper . . . and thus tougher for industry.

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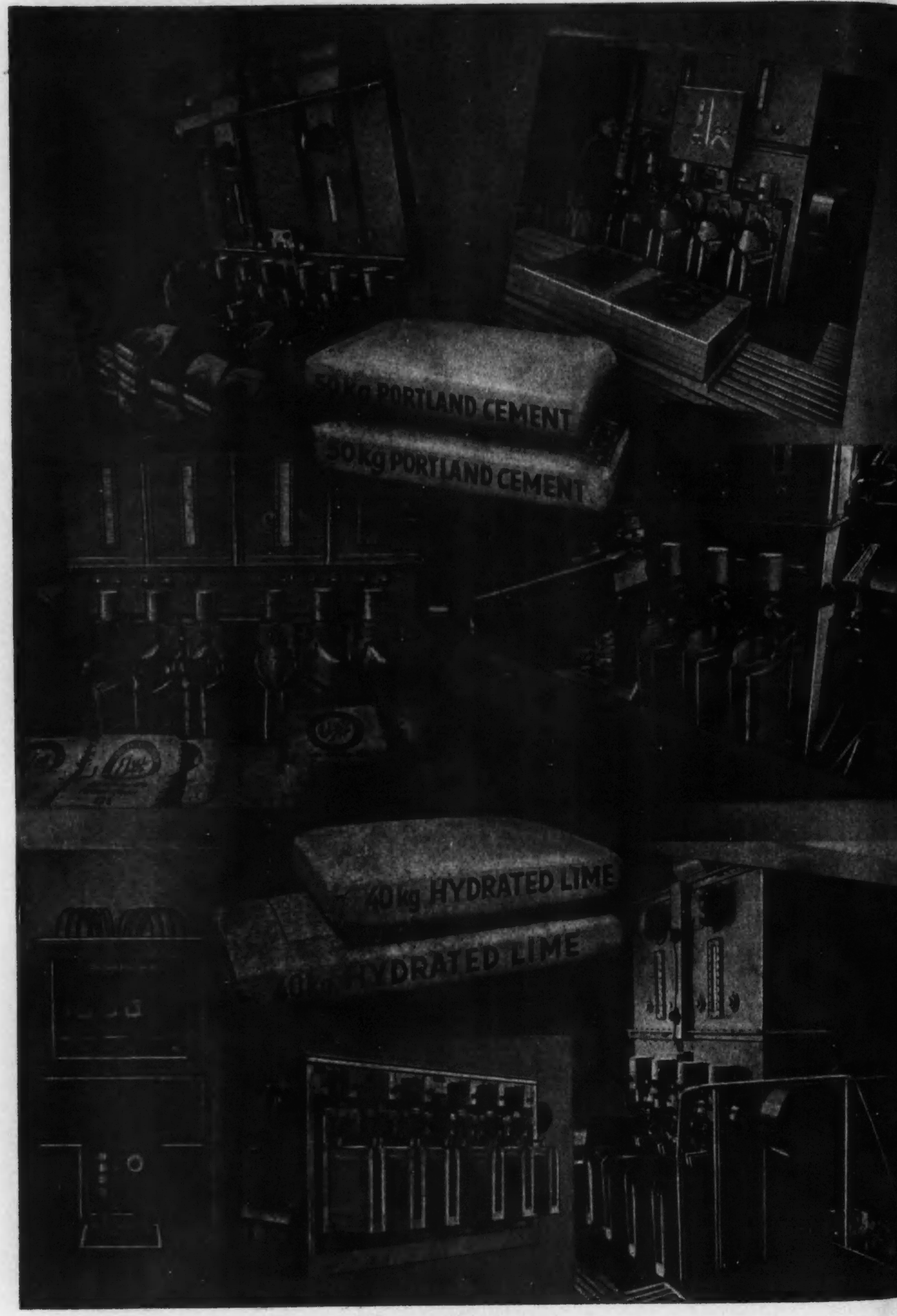

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PUBLISHED ALTERNATE MONTHS. PRICE 1s. A COPY. ANNUAL SUBSCRIPTION 6s. POST FREE. $1.30 IN CANADA AND U.S.A.

PUBLISHED BY
CONCRETE PUBLICATIONS LIMITED
14 DARTMOUTH STREET, LONDON, S.W.1.

TELEPHONE: WHITEHALL 4581.
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VOLUME XXVII. NUMBER 6. NOVEMBER, 1954

A Modern Packing and Despatching Depot.

A new Thames-side packing and distributing depot of the Cement Marketing Co., Ltd., is now in operation at Carnworth Road, London, S.W.6. The cement is delivered loose in lighters from works lower down the Thames and mechanically discharged into silos from which it is either packed in bags or delivered loose. *Fig.* 3 shows diagrammatically the arrangement of the plant. Views of the depot are shown in *Figs.* 1 and 2 and plans and cross sections in *Figs.* 4, 5 and 6. The depot is designed for storing and despatching by road up to 6000 tons of cement a week. An office block, sundries store, workshops, and covered space for thirty lorries are also provided. The packing and loading buildings have a reinforced concrete frame clad with asbestos-cement sheeting, except the lower parts where concrete blocks are used. The office and canteen are of reinforced concrete frame construction with a filling of lightweight concrete blocks. The building is remarkably free from dust; a complete installation is provided for vacuum-

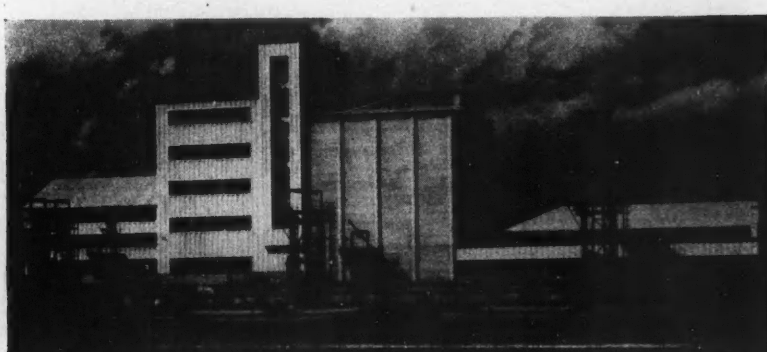


Fig. 1.—View from the River.

cleaning, but it has little work to do. It seems that the only possibility of dust arising is if a bag should burst between the packer and the lorry.

The Lighters.

Nine lighters, to be worked generally in groups of three, are provided, each with a capacity of 330 tons and a discharge rate of about 50 tons per hour. The discharging system within the lighter comprises a transverse scraper conveyor-elevator amidship to collect cement from floor level and deliver it to a small hopper formed in the deck. This hopper is the boot of the unloading bucket-elevator supported on the wharf (*Fig.* 7) and which delivers the cement to the conveying system feeding the silos.

The holds of the lighters have false floors formed of air-fluidising conveyors sloping at 8 deg. from the fore and aft bulkheads towards the centre and finishing flush with the trough of the scraper-elevator. The floor is divided into eight

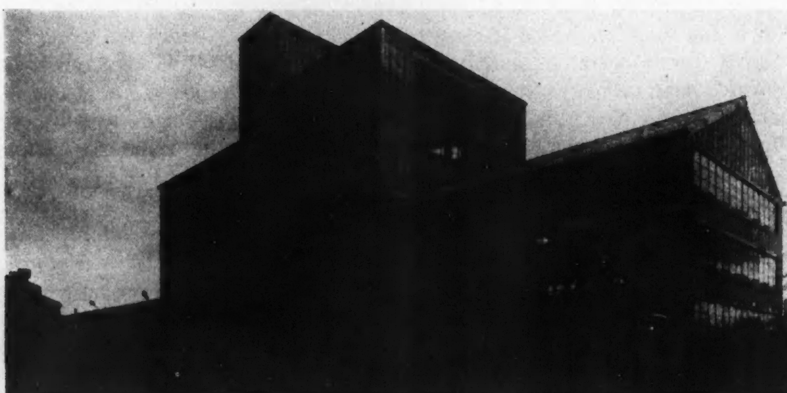


Fig. 2.—View towards the River.

sections each forming a longitudinal conveyor extending from one end of the lighter to the amidship section. A separate air-feed is taken to each conveyor at its lowest point. The sixteen air-pipes pass through the deck across the centre of the lighter and are joined to an air manifold; a cock on each pipe controls the air to whichever conveyor is required. A flexible pipe connects the manifold to a blower adjacent to each unloading station.

The central part of the lighter, in which the scraper-elevator is located, is enclosed by two transverse bulkheads extending from deck level to 1 ft. above the air conveyors. These isolate the machinery from the cement in the hold should any maintenance work be required on a loaded lighter. Longitudinal wash-plates extend from these bulkheads to half-way along each hold from deck level to the air conveyor surface; these stabilise the lighter while it is being loaded with fluidised cement.

The drive for the transverse scraper-elevator is by a $7\frac{1}{2}$-h.p. geared motor on the deck. A flexible cable with plug extends from the motor to a starter with an integral socket mounted on the side of the unloader elevator down which the 415-volts 50-cycles, 3-phase supply is carried from the wharf. Apart from an emergency stop-button there is no electrical control gear on the lighter. The drive is interlocked with the conveying equipment to the silos, so that if any check occurs in the conveying system the discharge from the lighter is automatically stopped. At present the hold of the lighter is covered with tarpaulin

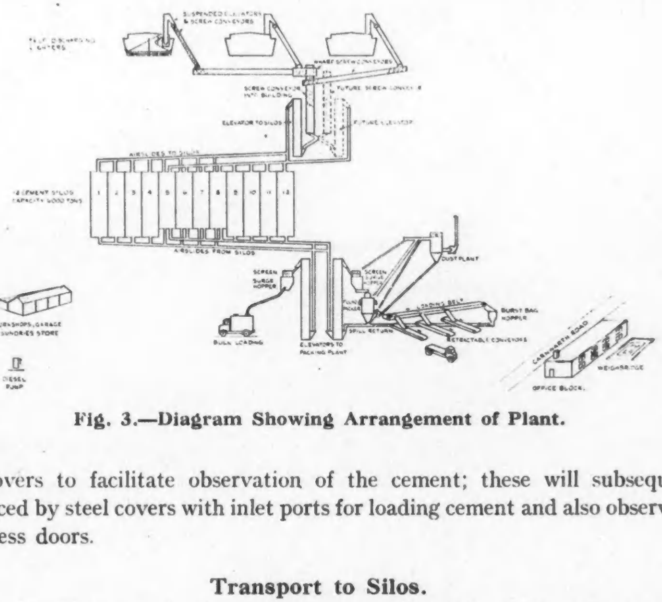


Fig. 3.—Diagram Showing Arrangement of Plant.

hatch-covers to facilitate observation of the cement; these will subsequently be replaced by steel covers with inlet ports for loading cement and also observation and access doors.

Transport to Silos.

Three fixed unloaders are provided on the wharf (*Fig.* 7), each comprising essentially a bucket-elevator, with a capacity of 50 tons per hour, mounted on a pivoted system which enables the elevator to rise and fall with the lighter as the tide varies. When the lighter is in position, the elevator is lowered into the deck hopper by means of a hand-winch; an apron on the elevator case and connected to the flange of the hopper forms a dust-tight connection. Forming part of each unloader, a screw-conveyor, flexibly connected to the bucket-elevator, discharges into screw-conveyors of 20 in. to 24 in. diameter which extend along the wharf to a mid-position, where they discharge into a 24-in. diameter screw which transports the cement to the silo conveying system. (When the second packer is installed a further transverse screw-conveyor of 20 in. diameter will be added.)

When the unloaders are not required they are raised to their highest position and swung in towards the wharf and locked, so that they are wholly on the wharf and cause no obstruction over the river. The electrical equipment for each un-

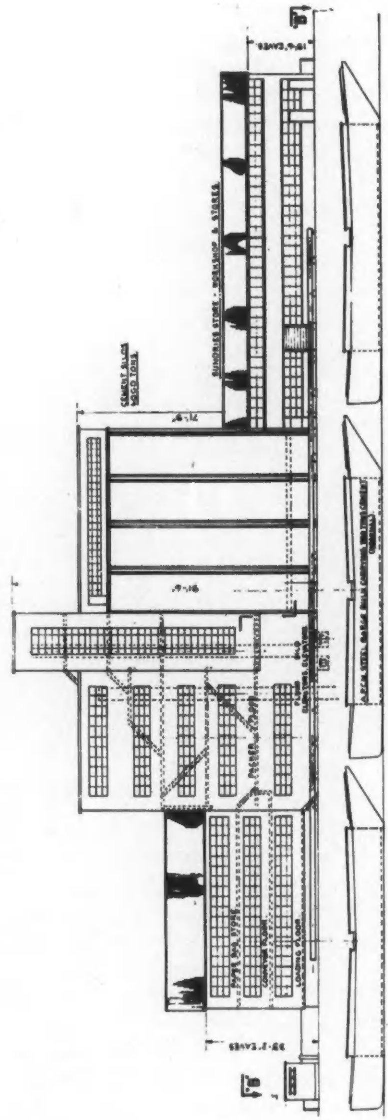
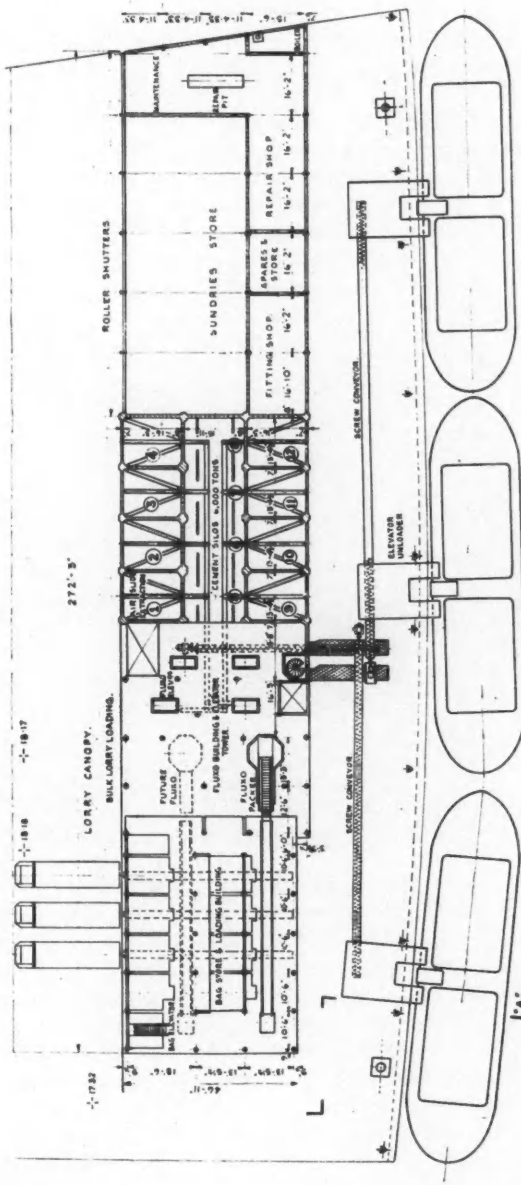


Fig. 4.—Longitudinal Sectional-elevation.



PLAN ON 'B-B'

Fig. 5.—Plan.

loader, together with that for the supply to the lighter, is mounted on the side of the steel structure.

In the conveyor system for the silos, the transverse screw which brings the cement from the wharf-side conveyors discharges it into slow-speed central-discharge elevator 86 ft. high with 24-in. buckets, which takes it to the top of the silos and discharges it either directly or by means of a transverse air-slide into one of two air-slides (seen in *Fig.* 8) which extend the length of the silos. The elevator and each air-slide have a capacity of 150 tons per hour, and by means of swivel ploughs the cement can be directed into the silo required. (The central row of silos is served by both air-slides, but the outer rows by one only.) Two high-speed fans, each having a capacity of 475 cu. ft. per minute at 30-in. water-gauge, provide the air for the slides; only one fan is normally required.

The main screw-conveyors along the wharf-side are at ground level; the covers are of the self-sealing type, and provision is made for draining away any water that might get into the seal.

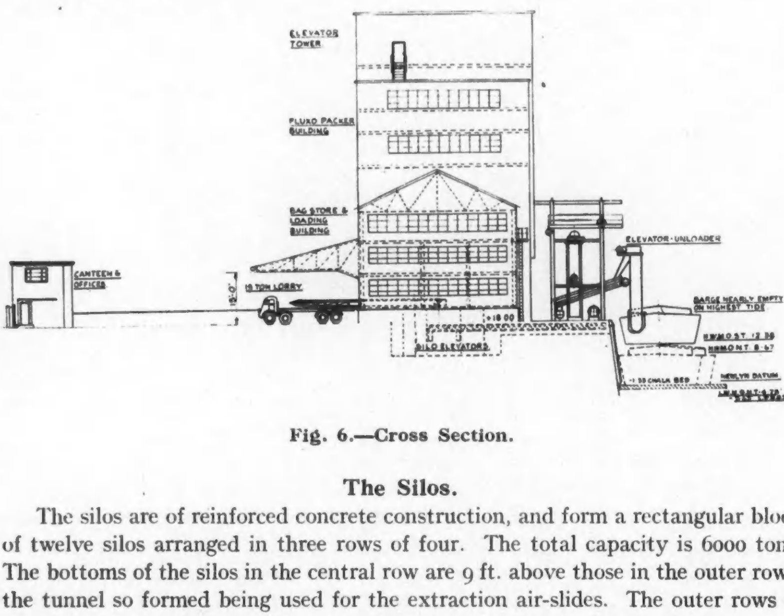


Fig. 6.—Cross Section.

The Silos.

The silos are of reinforced concrete construction, and form a rectangular block of twelve silos arranged in three rows of four. The total capacity is 6000 tons. The bottoms of the silos in the central row are 9 ft. above those in the outer rows, the tunnel so formed being used for the extraction air-slides. The outer rows of silos have access doors in this central tunnel, but access to the silos in the central row is either from the top or through the packing building, an access door being arranged in the end silo and this in turn giving entrance through successive manholes to the other three silos in this row. All construction joints in the external walls are provided with water-bars. A manhole of 2-ft. diameter is provided in the floor at the top of each silo, and provision is also made in one row of silos for loading loose cement.

Extraction of Cement.

Each silo is provided with three internal air-slides arranged in arrow formation to fluidise the lower layers of cement; the central air-slide is 1 ft. wide and the other two 8 in. wide. The cement from the silos is conveyed to the packing-plant elevators by means of two 12-in. air-slides with a capacity of 150 tons per hour. The rate of discharge from the silos is controlled by air-feeders; one feeder is provided for each of the eight silos in the outer rows, but for the central silos two feeders are provided so that the cement in this row may be delivered to either of the main extraction air-slides. Cross-over air-slides are provided so that either extraction air-slide may discharge into the elevator for either of the packing machines. Two blowers, each with a capacity of 520 cu. ft. of air per minute at a pressure of 3 lb. per square inch, are provided for the air-slides inside the

Fig. 7.—Discharging Cement from Lighters.

silos, and two high-speed fans, with a capacity of 450 cu. ft. of air per minute at 30 in. water-gauge, are provided for the air feeders and the two main extraction air-slides; only one blower and one fan are, however, required at any one time. The blowers and fans are on a platform at ground-level below one of the silos. The supply of air from the blowers is controlled automatically by electrically-operated unloading valves, which are operated by the high-level and low-level device in the hopper of the packer. The whole of the conveyor system is interlocked to ensure correct operation.

Packing.

Fig. 9 shows the top of the elevator feeding the rotary screen through which the cement passes before entering the packer-hopper. The hopper for supplying

Fig. 8.—Airslides from Top of Elevator to Silos.

Fig. 9.—Top of Elevator, Rotary Screen to the Right.

the packing machine and the pneumatic feeder are shown in *Fig.* 10; on the left of this illustration is the dust-extraction plant. The packer (*Fig.* 11) is a 12-spout Fluxo machine comprising a 24-in. slow-speed central-discharge elevator, a rotary screen, hopper, pneumatic feeder and packer, and dust filter. A control board is provided adjacent to the machine, the electrical equipment being of the contactor type in a cubicle on the second floor of the building. High-level and low-level devices of the Tektor type are provided in the packer feed-hopper to ensure that the head of cement is kept within the required limits.

An air compressor, with a capacity of 100 cu. ft. of air per minute at a pressure of 30 lb. per square inch, operates the pneumatic equipment, and provision is made for the installation of a second compressor. This compressor is driven through an

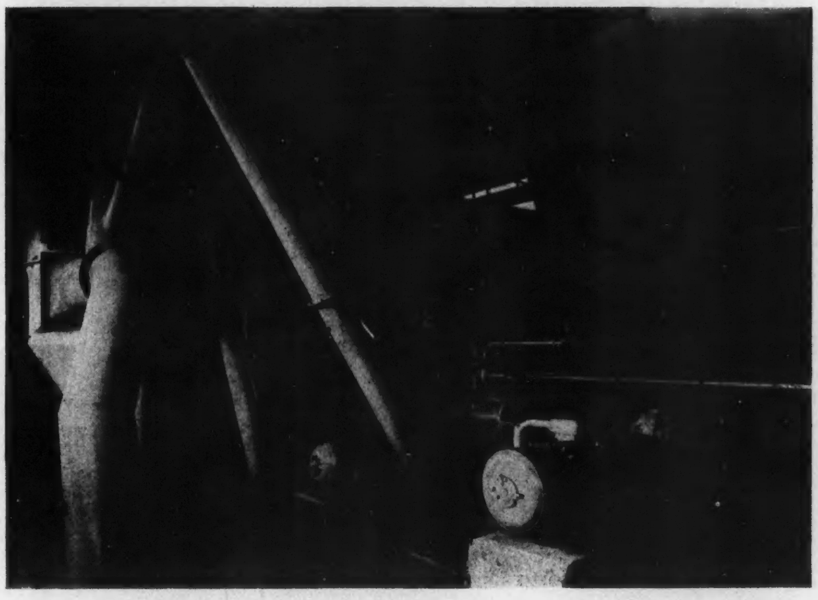


Fig. 10.—Packer-hopper and Pneumatic Feeder on Right. Dust-extraction Plant on Left.

hydraulic coupling so arranged that, when full pressure is reached in the air receiver, the compressor automatically stops while the motor continues to work normally. With this arrangement it is hoped to reduce the maintenance costs of the compressor.

Loading Bay.

The loading arrangement (*Fig.* 12) comprises a 24-in. flat-belt conveyor of sufficient length to allow for a future (fourth) loading point. A hopper for burst bags is provided at the end of the belt, so that the plough can be lifted to allow a damaged bag to go over the end of the conveyor. When changing loading points

Fig. 11.—The Packing Machine.

the plough is operated from a point adjacent to the retractable conveyor. A 12-in. by 16-in. screw-conveyor takes the cement back to the main packer elevator; the bags are removed by hand. The screw-conveyor extends below the loading floor, but openings are provided at intervals of 10 ft. 6 in. into which spilt cement may be swept. Three 24-in. flat-belt retractable conveyors (*Fig.* 13) are provided suitable for loading the longest lorries now in use.

Loading Loose Cement.

The elevator screen and hopper installed for the second packer are used for obtaining screened cement for loading loose into vehicles. The cement is taken

Fig. 12.—Conveyor from Packing Machine to Loading Dock.

from this hopper through a pipe and a flexible hose to the vehicle and provision is made to ensure, as far as possible, that the operation of filling the lorry shall be dust-free. A gangway under the main canopy provides easy access to the top of the lorry.

The bag store is over the loading bay and, when stacked to the maximum height of 9 ft., it has a useful capacity of about 750,000 bags.

Power Supply.

Two alternative supplies are provided by the London Electricity Board, whose substation is at a corner of the site. A 500-kVA. transformer reduces the supply from 11,000-volts, 3-phase, 50-cycles to 415-volts, 3-phase, 50-cycles. Two feeders connect the substation with the works' substation in the basement. The main switchboard in this substation is divided into two by means of a section switch, and the Board's two feeders are connected one to each half; this should ensure

Fig. 13.—Loading with Retractable Conveyor.

that at no time is the whole of the plant shut down as the result of a fault, and it also permits maintenance being carried out on half of the board while the other half remains in service.

The distribution boards are supplied from the main switchboard in the works' substation, and in turn supply the adjacent machinery; starters are in some cases of the hand-operated type and in others of the contactor type. All starters are fitted with isolating switches and, where necessary, emergency stop push-buttons are provided.

Extensions at Kent Works.

To provide facilities for loading the lighters at the works has necessitated extensive development schemes at Kent Works, Stone, near Greenhithe. The cement is extracted from nine existing silos and from two new reinforced concrete silos by air-slides which convey it to six 27½-in. diameter screw-conveyors. The capacity of the existing silos is 15,000 tons (about 1760 tons each) and the two new silos (28 ft. inside diameter by 80 ft. high) have a capacity of 1500 tons each.

The screw-conveyors feed to a belt-conveyor with a capacity of 300 tons per hour; the belts are 36 in. wide and move at a speed of 300 ft. per minute. The first belt is 765 ft. long and extends first along the ground and then in a gantry

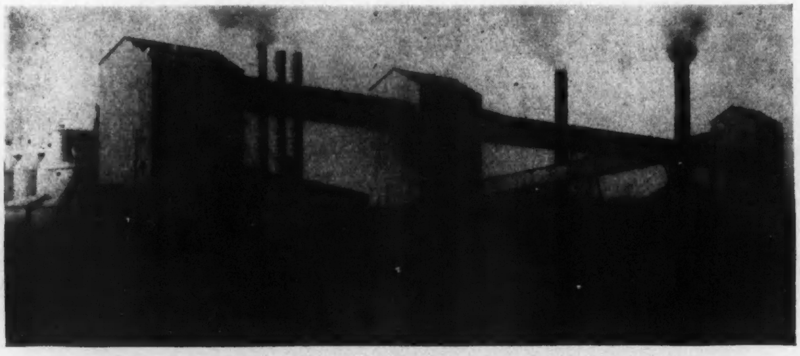


Fig. 14.—New Jetty for Loading Loose Cement at Works.

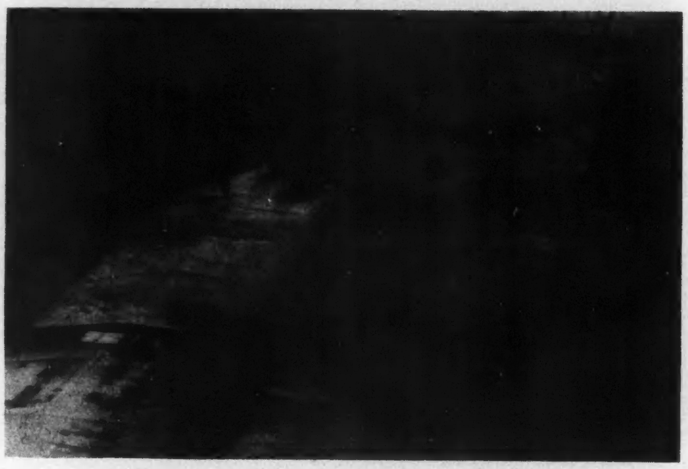
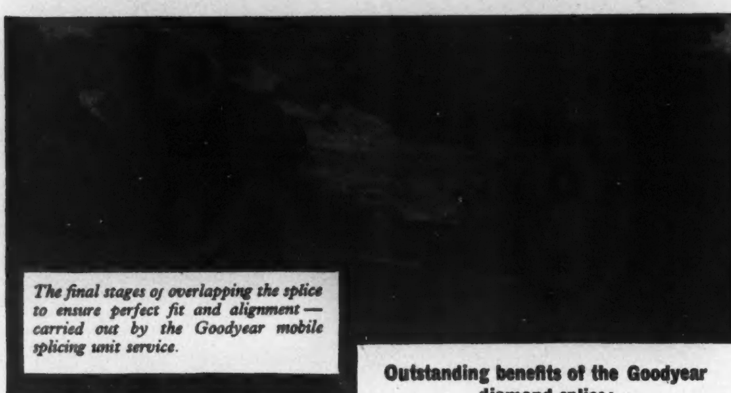


Fig. 15.—Loading a Lighter at the Cement Works.

over the existing jetty to a transfer-tower carried on a piled dolphin. The second belt-conveyor, about 330 ft. long, passes through an overhead gantry to two discharge houses on a new reinforced concrete jetty 150 ft. long and 30 ft. wide (*Fig.* 14), also on concrete piles. The jetty accommodates three lighters. The method of filling the lighters is by air-fluidising conveyors extracting from hoppers in the two houses. One lighter only is filled at a time (*Fig.* 15), the loading rate being the capacity of the conveying system, that is 300 tons per hour.

Dr. Oscar Faber & Partners were the consulting engineers for the depot, and the civil engineering work was carried out by Messrs. John Mowlem & Co., Ltd. Messrs. Bierrum & Partners were the contractors for the extension to the jetty at Kent Works.

DIAMOND SPLICING MOST USED METHOD—gives strongest joint



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The Influence of the Finest Particles in Portland Cement.

An investigation of the effects on the hardening and durability of Portland cements caused by removal of the finest particles is described by W. Czernin in "Zement-Kalk-Gips" for April, 1954. The following is a summary of the report.

Each cement was separated into a fine and a coarse portion by means of a Wolf air-separator. About 80 per cent. of the 0 to 4 μ fraction occurred in the fine portion, and the rest remained in the coarse portion. Any attempt to decrease the amount of the 0 to 4 μ fraction in the coarse portion was accompanied by an undesirable increase of the 4 to 8 μ fraction in the fine portion. Seventeen different cements were used. They were of ordinary and rapid-hardening Portland types, and of rotary-kiln and shaft-kiln origin. The percentage of fine particles separated ranged from three to nine, and removal of these particles produced an average reduction in specific surface of about 1,000 sq. cm. per gramme.

It was found that the fine portion had a disproportionately high SO_3 content. In order to obtain a true comparison of mortars with and without fines, the SO_3 content in the second case was corrected. This was done by adding the required amount of gypsum which had been passed through a sieve with 10,000 apertures per square centimetre. Removal of the fines rather unexpectedly caused a slight increase in the amount of water required to produce a standard mortar, but resulted in a considerable extension of the initial and final setting times. No definite trend in the results of "bleeding" tests could be observed, but deprival of fines slightly increased the spread of standard mortar in a drop test.

Tensile and compressive strengths at early ages were lowered by loss of fines; this effect was notably greater with rotary-kiln than with shaft-kiln cements, and was greater in the case of the more finely ground cements. Later strengths were substantially unaltered. Tests for resistance to frost were made on mortar specimens after moist storage for 56 days and immersion in water for three days. These were subjected to three cycles of freezing and thawing of minus to plus 20 deg. C. per day. Decrease in frost resistance due to loss of fines was clearly evident. Tests for resistance to aggressive solutions were carried out by measuring the expansion of prisms immersed in 5 per cent. magnesium sulphate solution. A high water-cement ratio (0·8) was used in preparing the specimens so that results would be rapid. Under these conditions resistance was improved by removal of fines.

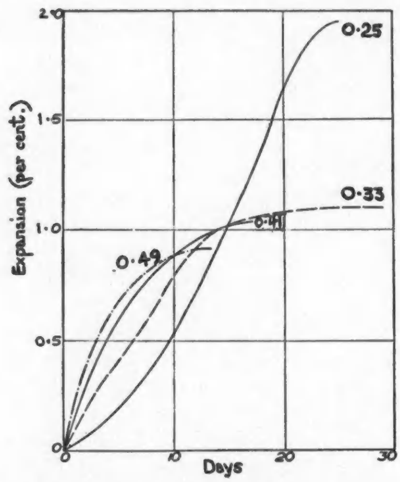
The loss on ignition of the fines was so large that all analyses were quoted free from it. The fine portion showed, besides the enhanced SO_3 content already mentioned, higher insoluble and much higher alkali content, especially potash. The calcium content and the silicate modulus were both lower in the fines than in the original cement. It has often been stated that the fines are richer in tri-calcium silicate; this could be true if the potassium were present as sulphate. The lower silicate modulus suggests that the iron and alumina compounds, or perhaps the glassy constituent of the clinker which contains them in preponderance, are among the more easily ground components.

Experiments with Expanding Cement.

THE Swedish Cement and Concrete Research Institute has issued a bulletin entitled "Experimentell jäm fördse mellan Lossiercement och standardcement i cementbruk," by Gunnar Lindh, in which are described experiments on the use of expanding cement. The bulletin is printed in the Swedish language.

The experiments were made to assess the value of the expanding cement invented in France by M. Henri Lossier in the construction of underground tanks for the storage of petrol. It was expected that concrete containing expanding cement would be subjected to an initial compression, with the result that leakage would be completely obviated, and that no metal lining would be necessary.

Most of the tests were carried out on specimens made of cement paste and cement mortar. Special attention was given to those factors which were considered to be most important in estimating the suitability of the concrete for



Expansions with different water-cement Ratios at Ages up to One Month.

underground petrol tanks, such as the amount of expansion particularly under the action of alternate curing in water and in air, resistance to frost, strength, and permeability. The results of the tests may be summarised as follows.

It is advisable to use a low water-cement ratio if great expansion is desired. For example, the expansion was 2 per cent. with a water-cement ratio of 0·25 and 0·9 per cent. with a water-cement ratio of 0·49. The expansion of cement mortar is about 20 per cent. of the corresponding value for cement paste, and the expansion of concrete mixtures seems to be considerably smaller. However, freedom from shrinkage can always be guaranteed. Alternate curing in water and in air was found to be an efficient method of stopping the expansion.

It was found that curing in water must take place during a relatively long period of time (not less than ten days) if the concrete is not to be damaged when exposed to frost. The modulus of rupture of expanded cement was lower than, or possibly in a few exceptional cases comparable with, that of ordinary Portland cement. A long period of water-curing is required to ensure good quality concrete. The water-absorption tests indicated that mortar made with expanding cement absorbs more water than mortar made with ordinary Portland cement.

The report concludes that so far as the properties of this expanding cement are known it cannot be regarded as advisable to use it in concrete for the construction of underground tanks for storing petrol. If expanding cement is so used then the water-cement ratio should be low and the water-curing period should be from two to four weeks.

Cement Production in British East Africa.

THE works of Uganda Cement Industry, Ltd., is now approaching its maximum output. It is expected that this works will meet all the requirements of Uganda and have a surplus available for export.

The cement works at Bamburi, Kenya, started production in April, 1954, at the rate of 100 to 120 tons a day. It is expected that the present two kilns will eventually produce up to 250 tons a day, and that when a third kiln is installed in 1955 the output will be 400 tons a day.

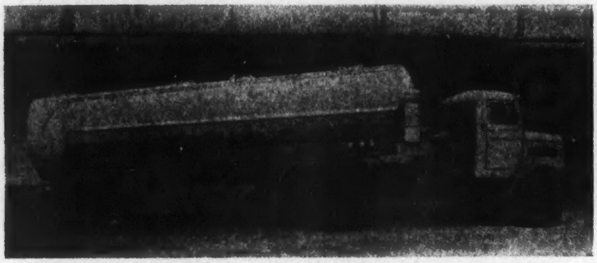
The Chairman of the Uganda Development Corporation, Ltd., said in the Uganda Legislative Council that there was a possibility of over-production of cement in East Africa within two or three years. It is understood that the Uganda Development Corporation is discussing with companies in the United Kingdom the possibility of partnership arrangements for the production in Uganda of asbestos-cement and cement products.

Cement Plant required in Canada.

The Export Services Branch of the Board of Trade states that Mr. Roger Jeanty, of Sogemines, Ltd., 1520 Mountain Street, Montreal, will be responsible for buying all the machinery for a $5,000,000 cement factory about to be erected near Edmonton. Mr. Jeanty wishes to receive preliminary information from United Kingdom manufacturers of crushers, mills, kilns, belt-conveyors, bagging machines, and all other equipment used in the production of cement. Construction of the factory is expected to commence in the Spring of next year. Firms interested in this enquiry should send full information about their products to Mr. Jeanty, quoting prices in Canadian dollars. If copies of correspondence are sent to the United Kingdom Trade Commissioner, 1111 Beaver Hall Hill, Montreal, it will enable the enquiries to be pursued on their behalf. Further information may be had from the Export Services Branch of the Board of Trade, at Lacon House, Theobalds Road, London, W.C.1, quoting reference C.R.E./11642/54 (telephone Chancery 4411, extension 776).

A Vehicle for Loose Cement.

THE illustration shows a vehicle used in Germany for transporting loose cement. The tank, which is inclined towards the rear to assist in the discharging of the cement, is carried on a trailer. Inside the tank is a Polysius airslide formed by porous slabs made with a mixture of burnt silicates or clay. As the tank is cylindrical in cross section and the slabs are flat there is a small space between the bottom of the slabs and the tank in which any moisture which may be present in



A Container for Loose Cement.

the tank will collect. Compressed air is supplied by a compressor driven by the engine of the towing vehicle, and the pressure is sufficient to eject the loose cement upwards to a tall silo. It is claimed that 13 tons of cement may be discharged in 8 to 15 minutes.

The tank may be divided into separate compartments so that several sites may be supplied by the same vehicle. The manufacturers (Haller G.m.b.H.) supply the vehicles with capacities of 12, 18, and 20 tons and a vehicle with a larger engine is available with a capacity of 25 tons.

Cement Production in Egypt.

THE production of cement in Egypt was 1,097,000 tons in the year 1953 compared with 947,000 tons in 1952. During the first four months of 1954 production was at the rate of 100,000 tons a month.

Cement Production in Colombia.

IT is reported that the production in Colombia during the present year is 60 per cent. greater than in the year 1953.

Cement Production in Norway.

IT has been decided to increase the capacity of the cement plant at Dalen by about 50 per cent., making the total capacity 450,000 tons a year.

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SITUATION VACANT

Published by CONCRETE PUBLICATIONS, LTD., 14, Dartmouth Street, London, S.W.1. England.
Printed in Great Britain by CORNWALL PRESS LTD., 1-6, Paris Garden, Stamford Street, London, S.E.1.